Efficient Market Managers*

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Abstract

We examine the effect of academic exposure to the ideas of the Efficient Market Hypothesis (EMH) on the investment behavior of mutual fund managers. We show that managers who are more likely to be exposed to the EMH during their higher education exhibit a greater propensity to manage index funds. When working for active funds, exposed managers tend to hold portfolios with larger numbers of stocks and to deviate less from their investment objective benchmarks than their unexposed peers. Familiarity with the EMH induces active managers to take on more systematic risk. Although exposure to the academic ideas does not result in better performance, it helps managers generate capital flows, especially when their funds charge lower expense ratios and belong to larger multi-fund families.

JEL classification: B31, D01, G23, G40

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Most capital market theories make assumptions about investor behavior and largely ignore the possibility that theoretical models themselves could influence the behavior of economic agents. The ideas of academic research are actively disseminated by academic institutions, the media, and professional associations such as the CFA Institute. Do academic ideas alter the behavior of market participants in some fundamental way? Who is more likely to adopt the academic views? How do existing norms and business practices interact with the adoption process? These questions remain virtually unexplored by economists and yet they could exhibit profound implications for our understanding of equilibrium market outcomes and the scope and limitations of economic analysis.

This paper addresses some of these questions by exploring how academic finance theory affects investor behavior in the context of the Efficient Market Hypothesis (EMH).The EMH, with its simple proposition that prices in financial markets fully reflect all available information, was among the most extensively tested theories in social sciences throughout the ’60s and ’70s, with hundreds of articles published in leading academic journals. In fact, Jensen (1978) declared that, “[t]here is no other proposition in economics which has more solid empirical evidence supporting it than the Efficient Market Hypothesis.” Due to this extensive body of academic research, the EMH became a dominant paradigm in academic finance by the late ’70s. The ideas of the EMH, however, diffused gradually throughout the academic community, creating a good testing environment for the interactions of academic research and real investment activity.

We find that mutual fund managers that are more likely to be exposed to the EMH during their higher education adopt more passive investment strategies. First, exposed managers are more likely to manage an index fund. Second, in actively managed funds, exposed managers tend to hold portfolios with larger numbers of stocks and lower active share and tracking error

measures relative to unexposed managers. The effect is well pronounced for both undergraduate and graduate education. Exposed managers take on more systematic risk (as measured by market beta) and although they charge lower fees, they generate similar raw and benchmark-adjusted returns as their peers. Exposure to the ideas of the EMH also helps funds generate larger capital flows.

We design our empirical strategy to examine the influence of the EMH on investor behavior as follows. First, we identify all academic articles published in top finance journals that contributed to the development of the efficient market hypothesis in the 1960s and 1970s. Based on this information, we classify all universities associated with the corresponding publications as EMH schools. For each EMH school, we define the year of EMH adoption as the publication year of the first EMH article by an affiliated author. We also obtain information on the educational background of U.S. equity mutual fund managers that were active from 1960 to 1995. We define portfolio managers as exposed to the EMH if they obtained at least one degree from an EMH school after the school published its first efficient market article. We use a sample of all U.S. equity mutual funds identified by Morningstar as having a single manager in the period from 1960 to 1995. We keep only single-manager funds to have a clean measure of exposure.

One of the main implications of the EMH for investment behavior is that more passive and better diversified investment strategies are superior to more active and less-diversified investment strategies. For example, the well-known Treynor–Black model of active investing recommends that a manager should deviate from the fund's benchmark portfolio only in stocks she has information on (Treynor and Black, 1973). As a result, we characterize the investment behavior of mutual fund managers in terms of their "activeness" using the Active Share measure

developed in Cremers and Petajisto (2009). Active Share measures the degree of deviation of a portfolio from its benchmark based on portfolio holdings. We also use the portfolio Tracking Error, calculated as the volatility of the fund excess return relative to the return of the fund's benchmark index, as an alternative metric. As advocated in Petajisto (2013), Active Share and Tracking Error capture different aspects of active management.

Our final step is to estimate difference-in-difference regressions of the effects of EMH exposure on Active Share, Tracking Error, and other portfolio characteristics where the unit that receives treatment is the alumni of a given university. The first difference compares the portfolio characteristics of managers graduating from an EMH school relative to the portfolio characteristics of managers from non-EMH schools. The second difference compares the portfolio characteristics of managers graduating from an EMH school post-EMH adoption to the portfolio characteristics of managers graduating from an EMH school pre-EMH adoption.

After verifying that exposed managers are more likely to work for an index funds, we focus our main analysis on actively managed funds to examine the effects of the EMH on a full spectrum of managerial behavior that is not constrained by explicit indexing. Our finding that active managers exposed to the EMH follow more closely the diversification and benchmarking strategies advocated by academic finance theory is highly economically and statistically significant. Compared to their peers, exposed managers have roughly 10% lower Active Share and Tracking Error measures, and hold portfolios with 25% more stocks. The finding is also not driven by the characteristics of early-adopting schools – we show that the trading behavior of managers graduating from an EMH school before the school started publishing on efficient markets is not statistically different from the behavior of managers graduating from late-adopting schools. Thus our results indicate that the act of publishing on the topic of efficient markets

changes the behavior of affiliated managers. The difference-in-differences model, combined with extensive controls for time-varying covariates and time-, graduation decade-, and investment style-fixed effects, suggests a causal interpretation of our results.

A straightforward recommendation of the EMH for an active manager is to take on more systematic risk. Stock-picking is largely based on idiosyncratic information and if a manager believes that stock-picking does not provide superior performance she is expected to reduce her exposure to idiosyncratic risk. Relative performance evaluation could further incentivize portfolio managers to take on more systematic risk. In particular, it is well documented that in an attempt to beat their benchmarks managers tend to shift the composition of the portfolios towards high-beta assets (Christoffersen and Simutin, 2017). Consistent with this risk-shifting prediction, we show that the portfolio returns of exposed managers have higher market betas than the portfolios of unexposed managers.

Next, we evaluate the implications of academic exposure to the EMH for investment performance. Despite the fact that they charge lower fees, exposed managers generate similar raw and benchmark-adjusted returns to the returns of unexposed managers. Exposure to the EMH, however, helps managers generate larger capital inflows. In particular, we find that the flows of exposed managers are around 6% larger than the flows of their peers, which accounts for more than 13% of the standard deviation of flows across the sample.

To understand better the link between EMH exposure and mutual fund flows, we interact the exposure variable with various fund characteristics. Mutual fund flows respond to a variety of factors, only one of which is performance. For example, Gennaioli et al. (2015) emphasize the importance of trust for investors' choice of a portfolio manager. There is also evidence that advertising strategies and positive media coverage help funds generate capital flows (Jain and

Wu, 2000; Reuter and Zitzewitz, 2006). We find that the exposure effect on mutual fund flows intensifies for funds with lower fees, suggesting that managers exposed to the EMH may be able to attract more investors by highlighting the lower expense ratios of their investment strategies. We also find that exposed managers attract more capital inflows if their fund belongs to a larger multi-fund family.

To the best of our knowledge, this is the first study that systematically examines the effects of a major capital-market theory (the EMH) on investor behavior. A growing literature in finance seeks to understand investment behavior in terms of individual innate characteristics and personal experiences. This literature has identified various personal factors related to investment behavior, such as intellectual ability (Chevalier and Ellison, 1999; Grinblatt, Keloharju and Linnainmaa, 2012), family background and socio-economic status (Chuprinin and Sosyura, 2017), age and occupation (Betermier, Calvet, and Sodini, 2017), and exposure to economic downturns (Malmendier and Nagel, 2011). Our paper extends this literature by showing that exposure to specific ideas of academic research alters the behavior of economic agents.

The paper is related to the work of Graham and Harvey (2001), who study the implications of corporate finance theory for corporate CFOs. They find that while CFOs frequently employ some basic theoretical concepts in their financial decision making (e.g., present value techniques and the capital asset pricing model); they systematically ignore others (e.g., asset substitution, asymmetric information, and personal taxes). In a recent study, McLean and Pontiff (2016) show that academic finance publications on particular trading strategies significantly reduce the profitability of these strategies. All these studies are based on information in surveys or market outcomes and do not observe actual investor behavior. In

addition to focusing on different phenomena, an important contribution of our paper is that it observes and studies the behavior of an important group of market participants.

Our results have implications for asset pricing theory. A series of recent studies have shown that active managers tilt their portfolios towards stocks with greater systematic risk (Frazzini and Pedersen, 2014; Christoffersen and Simutin, 2017). Some researchers have further suggested that the additional demand for stocks with greater systematic risk has likely bid up their prices and contributed to the underperformance of high-beta stocks (Frazzini and Pedersen, 2014; Hong and Sraer, 2016). Economic models usually assume that the whole universe starts *anew* at 'time 0'. In reality, new ideas emerge within an elaborate set of existing norms, traditions, and practices and their interactions with the *status quo* could be very complex. Indeed, as the above research suggests, it is quite possible that academic finance research exhibits the potential not only to eliminate mispricing but also to facilitate mispricing in capital markets. If academic theory really affects the behavior of economic agents, then equilibrium asset pricing models might need to incorporate this feedback effect.

1. The EMH and its Implications for Investor Behavior

The efficient market hypothesis (EMH) was developed in the second half of the 1960s by economists in a small group of universities. The hypothesis originated from a line of research in applied mathematics studying the statistical properties of asset prices (e.g., Kendall and Hill, 1953; Osborne, 1962). The general conclusion of these early studies was that security price changes are random and unpredictable. One of the most systematic early examinations of capital market efficiency in finance was provided in the work of Fama (1965), who concluded that "the data seem to present consistent and strong support for the [random walk] model. This implies, of

course, that chart reading, though perhaps an interesting pastime, is of no real value to the stock market investor." Around the same time, Godfrey et al. (1964) studied daily and transaction stock prices and also concluded that the random-walk model provides a good description of the time-series variation of stock market prices.

Samuelson (1965) developed the first formal economic argument for "efficient markets." His insight is summarized by the title of his article: "Proof that properly anticipated prices fluctuate randomly." Samuelson described the stochastic process of stock prices as a martingale, rather than a random walk. The work on efficient markets throughout the '60s culminated in the widely cited and influential review article by Fama: "Efficient capital markets: A review of theory and empirical work" (Fama, 1970). In the review, Fama defined an efficient market as "[a] market in which prices always 'fully reflect' available information" and concluded that "the evidence in support of the efficient markets model is extensive, and (somewhat uniquely in economics) contradictory evidence is sparse." (p. 416).

The prevailing views on investments prior to the development of the EMH were about "active" investing or "stock picking." The intellectual foundations of stock picking or fundamental analysis were laid out in the classic text "Security Analysis" by Graham and Dodd, first published in 1934. This book was adopted as a college textbook and has influenced generations of individual and professional investors (Buffett, 1984). Another tenet of pre-EMH investment theories includes what Fama (1965) referred to as "chartist theories" or technical analysis. These theories promote stock price forecasting based on historical price information. These early approaches to investment analysis provided neither clear definitions of risk nor any insights on risk-return tradeoffs. For example, Graham and Dodd (1934) emphasized the "margin of safety" in security analysis, defined as the difference between the "intrinsic value" of a stock

and its market price. In technical analysis, the concept of risk was almost completely overlooked in stock forecasts. Assessing the risks of investment portfolios based on the stock forecast model of the "Dow Theory" proved to be difficult even after the development of modern portfolio theory (see e.g., Brown, Goetzmann, and Kumar, 1998).

Because the focal point of the EMH is investment performance, the hypothesis naturally led to the realization that risk is an important factor in capital market equilibrium. Building on this insight and the Markowitz (1952) mean-variance portfolio analysis, Sharpe (1964), Lintner (1965), and Mossin (1966) developed the first versions of the Capital Asset Pricing Model (CAPM). According to the CAPM, the expected returns of financial assets are determined by their systematic risks (or betas) and the market price for systematic risk. Most asset-pricing models developed at the time predicted that in equilibrium, systematic risk and expected returns are positively related and that if investors intend to achieve higher expected returns, they need to take on more systematic risk.

The EMH has distinct implications for active portfolio management. For example, the widely-applied investing framework of Treynor and Black (1973) provides a formal solution of the tradeoff between earning excess alpha vs. bearing idiosyncratic risk associated with active security selection. The solution states that managers should deviate from the market weight of an investment in proportion to the investment's Appraisal Ratio – the ratio of alpha and idiosyncratic risk. For a manager who combines the Treynor and Black (1973) model with a firm belief in the EMH, the costs of active stock picking arising from bearing more idiosyncratic risk and having higher information acquisition expenses are not compensated by earning excess alpha. An embrace of the EMH will thus result in a more "passive" approach to investing aimed at forming portfolios with large number of securities which closely mimic the market. Under the

EMH, this approach will be superior to an "active" approach of selecting a smaller number of stocks because these stocks will bear excess diversifiable risk without generating any alpha.

Managers exposed to the ideas of the EMH are also expected to shift the composition of their portfolios towards "high-beta" stocks – stocks with more systematic risk (Christoffersen and Simutin, 2017). Fund managers are generally evaluated and rewarded based on their performance relative to a benchmark. The EMH, in conjunction with early asset pricing theories, suggests that to generate positive net-of-benchmark returns managers have to increase the systematic risk of the stocks in their portfolios instead of following the traditional prescriptions of security selection.

As noted above, some of the ideas of the EMH originated from an earlier research in mathematical statistics and portfolio theory (Markowitz, 1952). We focus on the EMH instead of these theories because it offers much clearer predictions about investment behavior. The Markowitz' portfolio theory, for example, derives portfolio weights based on a quadratic optimization and does not provide any guidance on how the initial securities are selected or their covariance matrix estimated.

2. Empirical Strategy

2.1 Methodology

The starting point of our empirical methodology is to quantify the diffusion of the EMH ideas across U.S. universities throughout the '60s and '70s based on the publication records of their faculties. We first identify which schools adopted the EMH during this period (EMH schools) and in what year they did so. We then construct a *treatment group* of portfolio managers who attended an EMH school *after* it adopted the EMH ideas and a control group of portfolio

managers who attended an EMH school *before* it adopted the EMH ideas or who attended a non-EMH school.

More formally, we estimate the following regression model:

$$Y_{m,t} = EMS_{m,t} + EXP_{m,t} + Controls_{m,t} + \epsilon_{m,t}\,, \tag{1}$$

where $EMS_{m,t}$ is an indicator variable equal to 1 if the undergraduate or graduate institution of the manager published at least one article on the EMH in the'60s and '70s (EMH school), and zero otherwise; $EXP_{m,t}$ is an indicator variable equal to 1 if the undergraduate or graduate education institution of the manager is an EMH school *and* the manager graduated around the time the university published its first EMH article or later (exposure to the EMH); and $Controls_{m,t}$ includes a wide set of fund and manager characteristics as well as year-, graduation decade-, and investment style-fixed effects. Our dependent variables $Y_{m,t}$ include an indicator for an index fund (within the sample of all equity mutual funds) and measures of fund activeness, risk-taking, and performance (within the sub-sample of actively-managed funds).

In essence, our empirical methodology is a difference-in-differences estimation where the units that receive treatment are the alumni of a given university instead of individual fund managers. Some university alumni never receive treatment because their university is not an EMH school under our definition.[1] These university alumni enter the control group. Some university alumni receive treatment after a given time period because they attended an EMH school after its first EMH publication. As a result, our difference-in-differences term captures the effect of EMH on behavior for managers who attended an EMH School after its first EMH article. In our baseline specification, we also include graduation time–fixed effects to control for

[1] We control for EMH schools since early adopters could be associated with different pools of students and social networks all of which could influence trading behavior (see e.g., Cohen et al., 2008).

time effects and an EMH dummy (and other school time invariant characteristics) to control for time-invariant differences of efficient market schools.

Given the delay in the publication process, it is likely that research on the EMH (and possibly teaching of the EMH) were adopted at a university some time before the publication date of the first academic article on the topic in a top academic journal associated with this university. In our baseline models, we assume that a manager was exposed to the EMH if he or she graduated from a school three years before it published its first EMH paper or later. As an illustration, since Baruch College published its first EMH paper in 1972 (Table 1), all portfolio managers who obtained their undergraduate degrees from Baruch College in 1969 or later are assumed to have an exposure to the EMH ideas, while all managers who obtained their undergraduate degrees form Baruch College prior to 1969 are assumed to have no exposure to the EMH. In robustness checks, we also consider alternative specifications of the exposure variable by varying the definition of exposure from five years before publication to one year after publication of the first EMH article in a leading finance journal. We also consider versions of the exposure variable focusing only on undergraduate or graduate education.

2.2 Identifying exposure to the EMH

Figure 1 shows that the EMH diffused gradually through society. The figure plots the annual frequencies of the expression "efficient market hypothesis" found in sources printed between 1940 and 2008 based on Google Ngram Viewer. The figure shows that the term "efficient market hypothesis" started appearing in publications for the first time in the late 1960s and that the usage of the term expanded gradually throughout the 1970s and the 1990s. The slow

diffusion of the EMH ideas during the early time period allows us to design an identification test of the impact of exposure to the EMH on managerial behavior.

To identify the early adopting institutions (EMH schools), we start by downloading all academic articles published between 1960 and 1979 in the five top finance journals at the time: Financial Analyst Journal (FAJ), Journal of Business (JB), Journal of Finance (JF), Journal of Financial Economics (JFE), and Journal of Financial and Quantitative Analysis (JFQA). We add FAJ to the list because this journal is widely followed by the investment community. FAJ, JB, and JF cover the entire 20-year period, JFQA covers the post-1966 period, and JFE covers the post-1974 period. Our search generates 5,124 journal articles in PDF format that satisfy these criteria.

We focus on the period from 1960 to 1979 because it coincides with the initial diffusion of the EMH ideas in academic circles. The first articles on the topic were published in the early 1960s. West (1974) argues that by 1974 the EMH was still not widely taught in investment classes. Specifically, he reviewed the five main investments textbooks available at the time and found that only one of the five books endorsed efficient markets: "*Investments: Analysis and Management*" by Francis (1972). Yet, around the same time, the efficient market paradigm was gaining popularity in academic circles (see Table 1), suggesting that a significant variation in exposure to these ideas existed across academic institutions during this time period. Focusing on earlier periods also allows us to identify better exposure through the education channel, since in later periods the EMH ideas very likely propagated via alternative channels such as personal communications, on-the-job training, and the media.

We next perform a regular-expression search of the full text of all articles. The two regular-expression searches are: 1) "efficien" followed or preceded within 20 characters by

("market" or "hypothesis"); and 2) "EMH," not caps specific. We find 195 articles that have 5 or more combined hits on the two regular-expressions searches. The authors of the paper then separately and independently read each article and excluded the ones that discussed efficiency in a different context (e.g., allocative or economic efficiency).[2] This resulted in 97 different efficient market papers and a set of universities associated with the authors of these papers.[3]

Our search covers only finance journals. Although some of the first EMH articles were published in statistical and other non-finance journals, including non-finance journals in the search could have over-identified exposure, as it is unlikely that portfolio managers were exposed to the EMH ideas in non-finance or non-economics classes. It is also possible that our search algorithm is missing some EMH articles in finance journals that do not talk explicitly about efficiency. To address the latter point, we extended our list by reviewing all academic articles cited in three review articles on market efficiency – Fama (1970), Fama (1991), and Schwert (2003). In particular, we identify articles from the references of these reviews that 1) explicitly discuss efficient capital market topics; 2) were not identified in the first search; 3) were authored by academics affiliated with a business school or an economics department; and 4) at the time of publication, were associated with schools that were not already selected on our list with an earlier publication date. This procedure added 6 more papers to the list, extending the number of efficient market papers to 103 articles associated with 46 unique EMH universities.

The first two columns of Table 1 report the 46 universities whose finance and economics faculty members published at least one efficient market article between 1960 and 1979, and the year when the first such article was published. The universities that could be credited with the first finance-related academic publications on capital market efficiency are Princeton University,

[2] We require that a majority of the authors agree on the exclusion.
[3] The majority of the authors of the efficient market papers were associated with universities; only a few were affiliated with government or private-sector organizations.

University of Chicago, and MIT. Other "early adopters" of EMH ideas are the University of Washington, University of Rochester, and Washington University in St. Louis. Table 1 indicates that the EMH also diffused gradually throughout the academic community – while only seven schools published on the EMH in the '60s, nine more schools adopted the idea in the early '70s, followed by the remaining 30 schools in the late '70s.

At the end, we note potential caveats in our classification of EMH exposure and how they may affect the identification of the exposure effect on manager behavior. First, it is likely that our approach misclassifies some unexposed managers as exposed. For example, a student who attended an EMH school may not be exposed to the EMH, either because she did not take the corresponding classes discussing these ideas, or, if she did, she did not internalize the views expressed by the professor. In other words, we observe only exposure to EMH ideas but we cannot verify with certainty whether these ideas were adopted by a particular manager. Over-identification of exposure could also result from the possibility that college graduates who pursue a career in active investment management may be more likely to disagree with the ideas of the EMH. We may also misclassify some exposed managers as unexposed. For example, it is possible that the efficient market ideas were present at a school a long time before an affiliated professor published an EMH article in a top finance journal. We note, however, that all these misclassifications would decrease the statistical power of our tests and their ability to detect a significant exposure effect.

2.3 Constructing the mutual fund manager sample

We construct our initial mutual fund sample from the Morningstar Direct database. We first identify all open-end mutual funds that are domiciled and available to investors in the

United States. We keep only one mutual fund share class per portfolio, by selecting the class that is designated by Morningstar as the "Oldest Class." For multi-class mutual fund portfolios that do not have a designated "Oldest Class," we keep the class with the earliest inception date. After keeping one class per portfolio, we are left with 5,559 unique U.S. equity mutual funds.

We obtain from Morningstar biographical information on the fund managers for each of the 5,559 funds. The Morningstar manager history data item contains the manager name and the beginning and ending date of the period during which each manager was involved with the fund. We drop all fund years that are designated as "Team Managed" by Morningstar or that have more than one person listed as the active manager. We then retain all observations of single-managed funds that were active for at least one year between 1960 and 1995. The resulting sample contains 1,207 fund managers and 851 unique mutual fund portfolios, noting that some fund managers may be managing multiple funds from 1960 to 1995.

For each portfolio manager in our sample, we collect information on the names of their undergraduate and graduate universities and the corresponding graduation years from their biographies in Morningstar. We also construct an indicator variable for an MBA degree if we identify such information in the managers' biographical information. We complement our data on managers' education with information from records of university alumni publications available at ancestry.com, the Nelson Directory of Investment Managers, the Bloomberg Executive Profile database, and LinkedIn.

We merge the Morningstar sample with the Thomson Reuters CDA/Spectrum Mutual Fund Holdings Database. We also obtain other fund characteristics, such as TNA and expense ratios, from the CRSP Survivor-Bias Free U.S. Mutual Fund Database using MFLinks. The funds with multiple classes in the CRSP fund sample are matched and aggregated at the fund

portfolio level. We follow Pastor, Stambaugh, and Taylor (2015) to merge the fund holdings and CRSP fund data with the Morningstar fund manager data. We limit our analysis to domestic equity funds with total net assets (TNA) of at least $10 million as of the last quarter end.

Our sample includes both actively managed funds and index funds. To identify index funds, we start by selecting all funds classified as following an "indexing strategy" in the CRSP mutual fund database (*index fund flag* equal to "Index based", "Pure index fund", or "Index enhanced"). Afterwards, among all remaining funds we identify the ones whose names contain the words "index," "S&P," and other commonly used stock index names. We manually check the SEC filings of these identified funds and add them to the index fund sample if they are confirmed to be index funds. The final sample consists of 58 index funds and 793 actively managed funds.

The last two columns of Table 1 report the number of portfolio managers who obtained their undergraduate and graduate degrees from the corresponding schools. We observe that our mutual fund sample covers 45 of the 46 EMH universities on the list. Among mutual fund managers, some universities are more popular for undergraduate degrees (e.g., Princeton and Duke), other universities are more popular for graduate degrees (e.g., University of Chicago and New York University), while other university are popular for both undergraduate and graduate degrees (e.g., University of Pennsylvania and Dartmouth College).

Table 2 presents the distribution of the sample across the graduation-year decades associated with the portfolio managers' undergraduate (Panel A) and graduate (Panel B) degrees. The sample spans eight decades. Around 70% of portfolio managers finished their undergraduate degree in the 1960s and 1970s; 65% of managers finished their graduated degrees in the 1970s and 1980s. Around 13% of the sample covers managers exposed to the EMH at their

undergraduate institution, while 25% of the sample covers managers exposed to the EMH in graduate school. Not surprisingly, the fraction of exposed observations increases over time till the 1970s (for undergraduate exposure) and the 1980s (for graduate exposure). The fraction of exposed observations drops in the later periods because the sample is censured on the right. To control for possible selection issues, in addition to year-fixed effects, we also include graduation decade-fixed effects in all model specification.

3. Implications of the EMH for Investor Behavior

3.1 Employment in index funds

We start our empirical analysis by exploring whether exposure to the ideas of the EMH affects the propensity of a manager to work for an index fund. Table 3 calculates the percentages of funds managed by exposed managers across the active fund and the index fund subsamples. We further stratify the two subsamples based on the fund founding year because index funds became gradually more prevalent. The last row of the table reports the total number of all funds and the total number of funds managed by exposed managers.

We find that regardless of the period when a fund was founded, the sample of index funds has a much higher percentage of exposed managers than the sample of actively managed funds. In the overall sample, 40% of index funds are managed by exposed managers, versus only 22% of active funds. The participation rates across the two types of funds are also significantly different – a Chi-square test whether the proportions of exposed managers in the two subsamples are the same has a value of 10.09 (p-value of 0.001). If we change the frame of reference, 11.9% of exposed managers in our sample manage index funds versus only 5.3% of unexposed managers.

In the subsequent sections, we explore in greater detail the implications of exposure to the ideas of the EMH for active mutual fund managers. Active portfolio management has been the dominant form of portfolio management in the mutual fund industry throughout the ’80s and ’90s, the time period of our study. More importantly, the dynamic characteristics of actively managed portfolios allow us to establish a direct link between managerial exposure to the EMH and investment decisions.

3.2 The sample of actively managed funds

Table 4 reports distributional characteristics of the main variables in the sample of actively managed funds. The average portfolio in the sample has 126 stocks, the average fund is 17 years old, and the average manager spends 7.2 years at a fund. We also observe that all portfolio characteristics exhibit substantial variation across funds. For example, with respect to fund age and manager tenure, some funds in our sample have existed for more than 60 years, while some portfolio managers have spent more than 25 years at a given fund.

Around 40% of the observations are associated with a manager who obtained her undergraduate or graduate degree from an efficient market school (EMH School), while around 22% of the observations are associated with a manager who obtained her undergraduate or graduate degree from an EMH school three years before it published its first finance academic article or later (Exposure to EMH).

The percentages of the sample observations associated with managers who obtained their undergraduate degrees from an efficient market school (UEM School) and who were exposed to the EMH ideas in their undergraduate school (U-exposure to EMH) are 28% and 13%, while percentages of the sample observations associated with managers who obtained their graduate

degrees from an efficient market school (GEM School) and who were exposed to the EMH ideas in their graduate school (G-exposure to EMH) are 38% and 25%, respectively. More than half of the observations in the sample are associated with managers with graduate degrees. The majority of managers with a graduate degree have an MBA (80%). We also observe that while only around 24% of the undergraduate degrees in the sample are from elite schools, the share of graduate degrees from elite schools is 44%.[4]

3.3 Trading behavior in actively managed funds

As noted above, the EMH advocates the view that passive and well-diversified trading strategies are superior to active and less-diversified investment strategies. Our main measure of active investing is *Active Share*, developed in Cremers and Petajisto (2009) and further extended in Petajisto (2013). Active Share is defined as one half of the sum of the absolute value of active weights:

$$Active\ Share = \frac{1}{2}\sum_{j=1}^{N}\left|w_{j,fund} - w_{j,benchmark}\right|, \quad (2)$$

where $w_{j,fund}$ and $w_{j,benchmark}$ are the weights of stock j in the fund portfolio and the benchmark portfolio, respectively. The Active Share measure ranges from zero, when the portfolio is identical to its benchmark, to one, when the portfolio holds only non-benchmark securities. Since mutual fund holdings information is available on a quarterly basis, the Active Share measure is updated each quarter. Following Cremers and Petajisto (2009) and Petajisto (2013), we define fund benchmarks based on the stock indexes the mutual funds identify in their prospectus as their investment objective benchmarks.[5]

[4] Elite schools are defined following Lerner and Malmendier (2013) as all Ivy League schools plus Caltech, the University of Chicago, Duke, MIT, Stanford, and the Universities of Cambridge and Oxford.
[5] We obtain the benchmark information from Petajisto's website (http://petajisto.net/data.html).

As an alternative measure of fund active investing, we also employ tracking-error volatility, or Tracking Error. While Active Share is a proxy for active stock selection relative to the benchmark, Tracking Error is a proxy for deviations from the benchmark systematic risk. In particular, Tracking Error is defined as the time-series standard deviation of the difference between fund returns, R_{fund}, and the returns of its benchmark index, $R_{benchmark}$, computed based on the prior 6 months of daily returns as follows:

$$Tracking\ Error = Stdev\left(R_{fund} - R_{benchmark}\right) \quad (3)$$

The EMH also suggests that managers should take on more systematic risk. We measure the systematic risk of a portfolio with the average market betas of the individual stocks in the portfolio calculated over the previous twelve months.

In Table 5, we explore whether managers' exposure to the ideas of the efficient market hypothesis during their undergraduate or graduate studies affects their propensity to invest actively and take on more systematic risk. The dependent variables are the portfolio Active Share measure, the portfolio Tracking Error, the number of stocks in a portfolio, and the fund market beta. The independent variables include an indicator for an efficient market school, an indicator for an exposure to the efficient market ideas at an efficient market school, and additional firm and manager characteristics. All models also include investment style–, year–, and graduation decade–fixed effects, and standard errors in all models are adjusted for clustering at the year level.

We find that the portfolios of managers exposed to the EMH exhibit smaller Active Share and Tracking Error measures, indicating that these portfolios follow more closely broad market indices. Exposed managers also tend to hold a larger number of stocks in their portfolios. Our main findings are highly economically and statistically significant: compared to their peers,

exposed managers have roughly 10% lower Active Share and Tracking Error measures, and hold portfolios with 25% more stocks.

The relation between active trading and fund size exhibits an inverted-U shaped relationship: active trading first increases and then decreases with the size of the portfolio. Berk and Green (2004) argue that active trading would tend to decline with fund size. Our results are generally consistent with this hypothesis – beyond a certain level, fund size correlates negatively with fund Active Share. Pastor, Stambaugh, and Taylor (2015) predict that competition of active managers reduces profitable opportunities and leads to reductions in Active Share. The investment style–fixed effects in our models control for the potential effect of competition on active trading. Finally, we show that managers with longer tenures at the fund trade more actively.

In the last model of Table 5, we explore whether exposure to the EMH affects fund manager risk-taking behavior. We find that managers exposed to the EMH take on more systematic risk as measured by the market betas of their portfolios. The control variables in the risk-regression indicate that managers with a graduate degree are more likely, while managers with a longer tenure at a fund are less likely to take on systematic risk.

3.4 Pre-treatment balance and other robustness tests

Table 1 suggests that the group of early-adopting schools of the EMH might not represent a random subsample of universities. For example, it appears that Wharton, Chicago, Stanford, Dartmouth, and MIT account for about half of the exposed managers and these are highly selective institutions. Is it possible that the distinct investment behavior of exposed managers simply reflects some distinguishing features of early-adopting schools? Our empirical

methodology already controls for early-adopting schools with a fixed effect. Nevertheless, to mitigate these concerns we also estimate a "pre-treatment balance" test evaluating the investment behavior of managers graduating from EM Schools before these schools published their first academic article on efficient markets (pre-treatment periods).

Table 6 shows the results from this pre-treatment balance test. The active share and tracking error measures of EMH-school managers pre-treatment are not statistically different from those of managers graduating from late-adopting schools. Interestingly, managers graduating from EMH Schools in the pre-exposure period tend to hold portfolios with *smaller* number of stocks compared to the portfolios of managers graduating from non-EM Schools. We also find that managers graduating from EM Schools over pre-exposure periods tend to have *smaller* market betas. These results suggest that the indexing tendencies of managers graduating from schools that adopted the EMH in the 1960s and 1970s are very likely a result of the adoption and not of any omitted characteristic of early-adopting schools.

In Table 7, we estimate the sensitivity of portfolio Active Share and market beta to EMH exposure for different definitions of the exposure variable. In our baseline models, we assume that the exposure starts three years before an affiliated faculty member of a university published its first academic article on the EMH in a leading finance journal. Here we consider the possibilities for earlier exposure (starting four years before the first publication) and late exposure (starting at the end of the publication year). We observe that the effect of managerial exposure to the EMH on both Active Share and market beta is robust across all model specifications.

Table 8 explores the link between managers' exposure to the EMH in undergraduate school and the characteristics of their portfolio. The results are generally consistent with the

baseline results: managers exposed to the EMH in their undergraduate education tend to hold portfolios with smaller Active Share and Tracking Error measures, larger number of stocks, and higher market beta. The relationship between active trading and fund size here also exhibits an inverted-U shaped relationship. An undergraduate degree from an elite university is associated with lower Active Share but higher Tracking Error.

In Table 9, we study the implications of manager exposure to the EMH in graduate school for investment behavior. Note that all models in the table are estimated over the subsample of managers with a graduate degree. Here, we also observe that exposure to the EMH results in lower Active Share measures, higher number of stocks in a portfolio, and higher market betas. Portfolio Tracking Errors are also negatively related to the exposure variable but the relationship here is not statistically significant. We also find that managers with a graduate degree from an elite school tend to trade more actively and take on less systematic risk.

We also separately examined all cases of managerial turnover in order to evaluate whether managers exposed to the ideas of the EMH transfer these ideas across funds. We were able to identify only a few cases of relevant migrations: 17 cases in which an unexposed manager is replaced by an exposed manager and 7 cases in which an exposed manager is replaced by an unexposed manager. Although the small number of turnovers does not allow us to conduct reliable statistical analysis over this subsample, it is interesting to note that the attrition rate of unexposed managers exceeds multiple times the attrition rate of exposed managers in the sample, suggesting that the EMH-ideas diffused gradually throughout the investment community over the sample period.

4. Implications of the EMH for Fund Performance

We next examine whether exposure to the EMH affects mutual fund performance, expense ratios, and fund flows. The first two models of Table 10 outline the results for net and benchmark-adjusted net returns (employing gross returns yields similar results). We find that both net returns and benchmark-adjusted returns of funds managed by managers exposed to the EMH are similar to the returns of funds managed by un-exposed managers. The control variables also indicate that older funds tend to underperform younger funds.

The third model of Table 10 shows that exposure to the EMH results in lower expense ratios. Less active trading strategies require fewer resources for the acquisition and analysis of investment information. As a result, managers who hold well-diversified portfolios are expected to have lower operating costs. Thus, the lower expense ratios of managers exposed to the EMH are consistent with their lower Active Share and Tracking Error measures of those managers.

In the last model of Table 10, we regress portfolio capital flows in a given year on indicators for an EMH school and exposure to the EMH, as well as a set of control variables measured over the previous year. All models also control for past mutual fund performance measured with net returns. Consistent with prior research, we find that past mutual fund performance predicts capital flows (see e.g., Barber, Huang, and Odean, 2016; Berk and Van Binsbergen, 2016). The effect of performance on flows is also economically significant – for example, the model indicates that a one standard deviation increase in past net returns around the mean increases fund flows with 44% of their standard deviation.

The last model of Table 10 also shows that managers exposed to the EMH generate larger capital flows than their peers. The EMH-exposure effect on flows is symmetric, that is, well-pronounced for both inflows and outflows, and robust to alternative measures of abnormal

performance (the Fama-French three-factor model and the Carhart four-factor model).[6] The exposure effect is also economically significant – exposed managers generate around 5% larger capital flows than their peers, which accounts for more than 11% of the standard deviation of flows across the population. The control variables in the fourth model Table 10 also show that flows tend to increase with fund size for small levels of fund size and to decrease with fund size for large levels of fund size. Younger funds also attract more flows than older funds.

Why are managers exposed to the EMH generating more flows than their peers? Performance is only one part of what investors consider and money managers seek to deliver in active portfolio management. Gennaioli et al. (2015) argue that another important factor guiding investors' choice of a portfolio manager is trust. There are numerous channels through which a manager could gain the trust of investors, such as personal relationships, friends and colleagues, and effective advertising. Indeed, a recent national survey conducted by FINRA shows that close to 50% of the respondents relied on friends, colleagues, or family members for investment advice, while more than 40% of the respondents obtained investment information from the media (Lin, et al, 2016). There is also evidence that fund advertising strategies and positive media coverage help funds generate capital flows (Jain and Wu, 2000; Reuter and Zitzewitz, 2006). Estimating a structural model, Roussanov et al. (2018) also find that marketing is nearly as important for determining fund size as performance and fees. In this respect, if the ideas of the EMH help managers gain investors' trust, then managers exposed to these ideas would be able to generate larger capital flows.

To better understand the link between EMH exposure and mutual fund flows, in Table 11 we interact the exposure variable with three different fund characteristics: fund expense ratio; fund past return; and an indicator variable for multi-fund families (families with at least five

[6] See Fama and French (1993) and Carhart (1997). These results are not tabulated.

different funds). The first model indicates that, although fund flows are not significantly related to expense ratios (consistent with Sirri and Tufano, 1998), the interaction of fund expense ratios with the exposure variable is significantly negatively related to flows. In other words, expenses become a more important factor for flows among managers exposed to the ideas of the EMH. The fact that the exposure effect on mutual fund flows intensifies for funds with lower fees suggests that managers exposed to the EMH may be able to attract more investors by highlighting the lower expense ratios of their investment strategies.

The second model of Table 11 shows that past fund performance does not affect the exposure-flow relationship, while the third model shows that the impact of EMH-exposure on flows is stronger for funds in multi-fund families (operating at least five different funds in a given year). It is possible that multi-fund families direct more flows to passive funds and less flows to active funds given that fund size is deterrent to mutual fund performance.

5. Discussion

The performance of actively managed mutual funds has been carefully benchmarked and evaluated by plan sponsors, information providers, and investors. One optimal managerial response to benchmarking suggested in the literature is to allocate the portfolio closer to the benchmark and to increase the systematic risk of the portfolio by shifting its assets towards high-beta stocks.[7] The intuition is straightforward: since the expected return of the market (and other broad market indices) is unconditionally positive, a portfolio that is more sensitive to the benchmark is expected to outperform the benchmark by more than a portfolio that is less sensitive to the benchmark.

[7] An alternative response would be leveraging the assets of the fund. However, mutual funds face leverage restrictions established by the Investment Company Act of 1940 and often self-impose stringent zero-leverage constraints (Boguth and Simutin, 2018). Almazan et al. (2004) document that few mutual funds use leverage.

Risk-shifting portfolio strategies are not trivial propositions. First of all, the theoretical justification of these strategies is fairly complex as it is based on the asset-pricing models developed throughout the ’60s and ’70s. Second, the implementation of these strategies requires sophisticated empirical analysis of stock returns and their co-movement with the returns of market indices. If index-tracking and risk-shifting in actively managed portfolios are indeed observed in the data, this raises the question of whether portfolio managers were indeed familiar with the complex quantitative relationships derived in the academic research throughout the 1960s and 1970s.

There are two logical possibilities. The first one is that managers know about the methods derived in academic research and they apply these methods without being consciously aware of them. In this scenario, academic research simply describes the economic reality in scientific terms but exhibits no impact on investor behavior. The second possibility is that (many) market participants were indeed unaware of the results presented in academic finance research around the time of publication. In this case, the adoption of academic paradigms in practice is only gradual, partial, and conditional on exposure to the source.

In this paper, we design an experiment to identify empirically the validity of these two hypotheses: academic finance research only describes the economic reality vs. academic finance research changes the economic reality. We present evidence consistent with the second alternative: portfolio managers who were exposed to the ideas of the EMH are more likely to adopt investment behavior consistent with these ideas.

Our analysis raises a series of potentially important questions. First, do equilibrium economic models need to incorporate the possibility that the behavior of some economic agents will be influenced by these models, while the behavior of others will be not? What demographic

and socio-economic characteristics influence the adoption rate of the model across the investment community? How does the adoption rate affect the validity of the model and how does model validity influence its adoption rate?

Our results also provide an insight into some of these questions. For example, we show that the portfolio managers who were influenced by the EMH appear to benefit from these ideas by attracting larger capital flows into their portfolios. Our results also imply that exposure to the EMH increased the demand for high-beta stocks, which, in turn, might have contributed to the relative overpricing of these stocks (Frazzini and Pedersen, 2014; Boguth and Simutin, 2018). Thus, our results suggest that academic finance research could have influenced the marginal investor in the market.

The findings in this paper also have implications for the literature on organizational culture and social norms. Every organization develops an organizational culture – a set of rules of behavior that are widely followed by its members. DiMaggio and Powell (1983) note that the emergence and existence of certain organizational forms could be traced to the educational institutions in society. In particular, they argue that "[u]niversities and professional training institutions are important centers for the development of organizational norms among professional managers and their staff" and that once graduates move away from the educational institutions to other organizations, they transfer their ideas with them. Our results broadly support this view on the evolution of organizational culture within the context of the money-management industry.

6. Conclusion

We quantify the diffusion of the Efficient Market Hypothesis across U.S. universities throughout the 1960s and 1970s based on the academic publications in all leading finance journals over the period and study whether (and how) academic ideas impact finance practices. Consistent with the investment implications of the EMH, we find that portfolio managers who were exposed to the EMH in their higher education are more likely to work for an index fund. Exposed managers working for actively managed funds, on the other hand, tend to hold portfolios with lower Active Share and Tracking Error measures and larger numbers of stocks. The adopters of the EMH also benefit from these ideas by generating more flows into their portfolios despite the fact that they do not deliver superior investment performance. Part of the additional flows could be attributed to the lower expense ratios associated with these investment strategies.

The paper contributes to the literature attempting to explain investor behavior and performance in terms of individual characteristics and experiences by showing that exposure to the ideas of academic finance research alters the behavior of economic agents. The feedback from academic research to the practice of investments suggests that a more complete description of the economic reality needs to reflect this feedback effect. The study also provides an insight into the evolution of corporate culture within the context of the money-management industry. In particular, it shows that the educational institutions in society could exhibit an important role for the dissemination of business practices across the economy.

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Table 1 – Efficient market schools
The table reports all universities whose faculty members have published at least one article on the efficient market hypothesis in top finance journals from 1960 to 1979; the year when the first article was published; the number of articles published by faculty members affiliated with the university; and the number of portfolio managers from our sample who obtained their undergraduate and graduate degrees from the corresponding university.

#	School Name	Year of First EMH Article	Number of Articles from 1960 to1979	Num. U-School Affiliated Managers	Num. G-School Affiliated Managers
1	Princeton University	1964	1	18	1
2	University of Chicago	1965	12	1	35
3	MIT	1965	2	13	12
4	University of Washington	1966	2	4	3
5	University of Rochester	1968	8	1	3
6	Washington University in St. Louis	1968	1	1	5
7	Carnegie Mellon University	1969	4	2	2
8	Stanford University	1972	7	9	24
9	Baruch College	1972	6	1	2
10	University of Pennsylvania	1972	6	25	49
11	SUNY, Buffalo	1972	3	5	1
12	University of Arizona	1973	3	0	0
13	Duke University	1973	1	8	5
14	University of Iowa	1974	4	5	2
15	University of Oregon	1974	2	2	3
16	CUNY, Queens College	1974	1	1	0
17	Iowa State University	1975	1	3	1
18	Michigan State University	1975	1	13	8
19	Rutgers University	1975	1	7	8
20	Tulane University	1975	1	1	2
21	University of Nevada, Reno	1975	1	1	1
22	University of Georgia	1976	2	1	1
23	University of Massachusetts	1976	2	3	2
24	UCLA	1977	5	7	8
25	Dartmouth College	1977	2	23	17
26	Purdue University	1977	2	1	2
27	University of Illinois	1977	2	10	4
28	University of Nebraska	1977	2	8	4
29	Georgia State University	1977	1	0	3
30	Ohio State University	1977	1	8	8
31	University of New Hampshire	1977	1	1	0
32	University of Rhode Island	1977	1	1	0
33	University of Utah	1977	1	3	2
34	Wellesley College	1977	1	5	0
35	York University	1977	1	1	0
36	University of Kansas	1978	2	4	3
37	University of Missouri	1978	2	5	3
38	California Polytechnic SU	1978	1	1	0
39	Florida State University	1978	1	4	1
40	University of Florida	1978	1	6	0

Table 1 (Contd.)

#	School Name	Year of First EMH Article	Number of Articles over 1960-1979	Num. U-School Affiliated Managers	Num. G-School Affiliated Managers
41	Indiana University	1979	1	7	7
42	New York University	1979	1	6	43
43	Northwestern University	1979	1	9	20
44	UC, Berkeley	1979	1	12	9
45	UC, Irvine	1979	1	1	1
46	UNC, Chapel Hill	1979	1	6	1

Table 2 – Distribution of the sample across portfolio manager graduation year decades
The table presents the distribution of the sample across graduation-year decades of the managers from the sample. Panel A focuses on undergraduate degrees, while Panel B focuses on graduate degrees.

Panel A. Undergraduate Degree

	Num. of Managers	Percent (Managers)	Num. of Observations	Percent	Percent Unexposed	Percent Exposed
1930s	3	0.30	29	0.26	0.26	0.00
1940s	18	1.82	490	4.43	4.43	0.00
1950s	79	8.00	1,221	10.99	10.99	0.00
1960s	323	32.69	4,421	39.93	38.68	1.25
1970s	370	37.45	3,773	34.04	26.42	7.62
1980s	190	19.23	1,116	10.06	5.90	4.16
1990s	5	0.51	31	0.28	0.28	0.00
Total	**988**	**100**	**11,081**	**100**	**87**	**13**

Panel B. Graduate Degree

	Num. of Managers	Percent (Managers)	Num. of Observations	Percent	Percent Unexposed	Percent Exposed
1940s	1	0.17	34	0.46	0.46	0.00
1950s	23	4.01	660	8.98	8.98	0.00
1960s	134	23.39	1,886	25.66	24.57	1.09
1970s	169	29.49	2,494	33.93	28.59	5.35
1980s	214	37.35	1,953	26.57	9.54	17.03
1990s	30	5.24	285	3.88	2.65	1.22
2000s	2	0.35	38	0.52	0.52	0.00
Total	**573**	**100**	**7,350**	**100**	**75**	**25**

Table 3 – Exposure to the EMH and employment in index funds

The table reports distributional characteristics of the mutual fund sample across fund founding year cohorts – the total number of funds, the number of funds managed by exposed managers, and the percentage of fund managed by exposed managers for active funds and index funds. The first panel of the table covers actively managed funds, while the second panel covers index funds. The last row reports the total number of all funds and the total number of funds managed by exposed managers.

	Active Funds			**Index Funds**		
Fund Founding Year	Number of all funds	Num. of funds managed by Exposed Managers	Percent of funds managed by Exposed Managers	Number of all funds	Num. of funds managed by Exposed Managers	Percent of funds managed by Exposed Managers
< 1970	141	18	13%	2	1	50%
1970-1979	42	6	14%	1	1	100%
1980-1989	289	63	22%	15	6	40%
1990-1999	321	84	26%	40	15	38%
Total	793	171	22%	58	23	40%

Table 4 – Sample characteristics of actively managed equity mutual funds

The table reports distributional characteristics of the main variables in the paper: the number of stocks in a portfolio, the portfolio Active Share measure, the portfolio Tracking Error, the fund expense ratio, annualized fund market beta based on net returns, annual fund net return, annual fund flows, an indicator variable for all managers who hold a degree from an EM school, an indicator variable for all managers who obtained a degree from an efficient market school three years before the school published its first efficient market article or later (Exposure to the EMH), indicator variables for all managers who obtained their undergraduate/graduate degree from an efficient market school (UEM School/GEM School), indictor variables for all managers who obtained their undergraduate/graduate degree from an efficient market school three years before the school published its first efficient market article or later (U-Exposure to the EMH/G-Exposure to the EMH), an indicator variable for managers with a graduate degree, an indicator variable for managers with an MBA degree, fund total net asset value, fund age, manager tenure, and Ivy league indicators for managers who obtained their undergraduate or graduate degrees from an Ivy league school (plus Caltech, University of Chicago, Duke, MIT, Stanford, and the Universities of Cambridge and Oxford). (†) indicates distributional characteristics within the subsample of managers with a graduate degree.

	Mean	Standard Deviation	P1	Median	P99
Num. Stocks	126	232	19	71	1292
Num. Stocks (log)	4.375	0.810	2.944	4.263	7.164
Active Share	0.819	0.194	0.008	0.869	0.997
Tracking Error	0.072	0.047	0.003	0.062	0.255
Expense Ratio	0.011	0.005	0.000	0.011	0.025
Market Beta	0.978	0.225	0.479	0.956	1.598
Net Return	0.180	0.174	–0.165	0.184	0.664
Fund Flows	0.126	0.452	–0.404	0.008	2.198
EM School	0.396	0.489	0	0	1
Exposure to the EMH	0.218	0.412	0	0	1
UEM School	0.283	0.451	0	0	1
U-Exposure to the EMH	0.130	0.337	0	0	1
Graduate Degree	0.556	0.497	0	1	1
GEM School†	0.377	0.485	0	0	1
G-exposure to the EMH†	0.247	0.431	0	0	1
MBA Degree†	0.800	0.400	0	1	1
TNA (log)	5.512	1.604	2.600	5.390	9.768
TNA (log) squared	32.964	19.047	6.758	29.053	95.420
Fund Age	16.956	15.989	1	11	66
Fund Age (log)	2.496	0.914	0.693	2.485	4.205
Manager Tenure	7.246	6.480	0	5	28
Manager Tenure (log)	1.810	0.812	0.000	1.792	3.367
IVY-plus U-School	0.237	0.425	0	0	1
IVY-plus G-School†	0.440	0.496	0	0	1

Table 5 – Exposure to the EMH and portfolio characteristics

The table reports coefficient estimates and p-values of OLS regressions of the portfolio Active Share measure, Tracking Error, number of stocks, and market beta on an indicator variable for all managers who obtained a degree from an EM school, an indictor variable for all managers who obtained a degree from an efficient market school three years before the school published its first efficient market article or later (Exposure to the EMH), (log of) total net asset value, (log of) total net asset value squared, (log of) fund age, (log of) manager tenure, and an indicator for managers with a graduate degree. All models include year–, portfolio investment style–, and manager graduation decade–fixed effects. Standard errors in all models are adjusted for clustering at the year–level. (^) indicates models estimated at annual frequency. (***), (**), and (*) indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

	Active Share	Tracking Error	Num. Stocks (log)^	Market Beta^
Exposure to the EMH	**–0.071*** **	**–0.007*** **	**0.251*** **	**0.039*** **
	<.0001	**0.0081**	**<.0001**	**0.0001**
EM School	0.003	–0.002	–0.090***	–0.049***
	0.4601	0.1113	<.0001	<.0001
Log(TNA)	0.014	0.000	0.080**	0.013
	0.1405	0.8541	0.0483	0.3393
$[\text{Log(TNA)}]^2$	–0.004***	0.000***	0.012***	–0.001
	0.0001	0.0025	0.0008	0.4976
Fund Age (log)	0.021***	0.000	–0.091***	0.012*
	0.0003	0.9697	<.0001	0.0698
Manager Tenure (log)	0.024***	0.005***	–0.023	–0.016**
	<.0001	<.0001	0.2616	0.0263
Graduate Degree	0.014***	0.003***	–0.090***	0.010***
	0.0002	0.0073	<.0001	0.0085
Intercept	0.540***	0.202***	4.275***	1.352***
	<.0001	<.0001	<.0001	<.0001
Year FE	Yes	Yes	Yes	Yes
Investment Style FE	Yes	Yes	Yes	Yes
Graduation Decade FE	Yes	Yes	Yes	Yes
Observations	11,056	11,052	3,943	3,716
R-squared	0.26	0.25	0.30	0.31

Table 6 – The portfolio characteristics of managers graduating from efficient market schools over pre-treatment periods

The table reports coefficient estimates and p-values of OLS regressions of the portfolio Active Share measure, Tracking Error, number of stocks, and market beta on an indicator variable for all managers who obtained a degree from an EM school, (log of) total net asset value, (log of) total net asset value squared, (log of) fund age, (log of) manager tenure, and an indicator for managers with a graduate degree. The sample excludes all observations associated with managers who graduated from an EM school three years before the school published its first academic article on efficient markets or later (post-treatment periods). All models include year–, portfolio investment style–, and manager graduation decade–fixed effects. Standard errors in all models are adjusted for clustering at the year–level. (^) indicates models estimated at annual frequency. (***), (**), and (*) indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

	Active Share	Tracking Error	Num. Stocks (log)^	Market Beta^
EM School	0.004	–0.002	–0.088***	–0.050***
	0.2582	0.1704	<.0001	<.0001
Log(TNA)	–0.028***	–0.001	0.156***	0.023
	0.0083	0.6283	0.0044	0.1111
$[Log(TNA)]^2$	0.001	0.000	0.002	–0.002*
	0.22	0.1059	0.6162	0.1016
Fund Age (log)	0.012**	–0.002**	–0.089***	0.010
	0.0404	0.0379	<.0001	0.1573
Manager Tenure (log)	0.020***	0.004***	–0.005	–0.014**
	0.0002	0.0004	0.8564	0.0265
Graduate Degree	0.026***	0.004***	–0.123***	0.010**
	<.0001	0.0034	<.0001	0.0408
Intercept	0.167***	0.099***	5.648***	0.981***
	<.0001	<.0001	<.0001	<.0001
Year FE	Yes	Yes	Yes	Yes
Investment Style FE	Yes	Yes	Yes	Yes
Graduation Decade FE	Yes	Yes	Yes	Yes
Observations	8,636	8,634	3,052	3,042
R-squared	0.24	0.25	0.27	0.19

Table 7 – Exposure to the EMH and portfolio active share and market beta for different definitions of the exposure variable

The table reports coefficient estimates and p-values of OLS regressions of portfolio Active Share measures (Panel A) and portfolio Betas (Panel B) on an indicator variable for all managers who obtained a degree from an EM school, an indictor variable for all managers who obtained a degree from an EM school K years before the school published its first efficient market article or later (Exposure to the EMH, K=4,3,2,1,0), (log of) total net asset value, (log of) total net asset value squared, (log of) fund age, (log of) manager tenure, and an indicator for managers with a graduate degree. All models include year–, portfolio investment style–, and manager graduation decade–fixed effects. Standard errors in all models are adjusted for clustering at the year–level. All models are estimated at quarterly frequency. (***), (**), and (*) indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

	Exposure (-4)	Exposure (-3)	Exposure (-2)	Exposure (-1)	Exposure (0)
Panel A. Active Share					
Exposure to the	**–0.061*** **	**–0.071*** **	**–0.091*** **	**–0.098*** **	**–0.095*** **
EMH	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**
EM School	0.000	0.003	0.008*	0.009*	0.006*
	0.9316	0.4601	0.0817	0.0622	0.0962
Observations	11,056	11,056	11,056	11,056	11,056
R-squared	0.25	0.26	0.26	0.26	0.26
Panel B. Portfolio Beta					
Exposure to the	**0.060*** **	**0.039*** **	**0.028*** **	**0.029*** **	**0.029*** **
EMH	**<.0001**	**0.0001**	**0.0032**	**0.0020**	**0.0017**
EM School	–0.060***	–0.049***	–0.042***	–0.042***	–0.042***
	<.0001	<.0001	<.0001	0.0001	0.0001
Observations	3,716	3,716	3,716	3,716	3,716
R-squared	0.31	0.31	0.30	0.30	0.30
% Exposed to EMH	22.5	21.8	19.8	19.0	18.6

Table 8 – Undergraduate exposure to the EMH and portfolio characteristics
The table reports coefficient estimates and p-values of OLS regressions of the portfolio Active Share measure, Tracking Error, number of stocks, and market beta on an indicator variable for all managers who obtained their undergraduate degree from an efficient market school (UEM School), an indictor variable for all managers who obtained their undergraduate degree from an efficient market school three years before the school published its first efficient market article or later (U-Exposure to the EMH), (log of) total net asset value, (log of) total net asset value squared, (log of) fund age, (log of) manager tenure, and an Ivy league indicator for managers who obtained their undergraduate degree from an Ivy league school (plus Caltech, University of Chicago, Duke, MIT, Stanford, and the Universities of Cambridge and Oxford). All models include year–, portfolio investment style–, and manager graduation decade–fixed effects. Standard errors in all models are adjusted for clustering at the year–level. (^) indicates all models estimated at annual frequency. (***), (**), and (*) indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

	Active Share	Tracking Error	Num. Stocks (log)^	Market Beta^
U-Exposure to the EMH	**–0.135*** **	**–0.014*** **	**0.353*** **	**0.075*** **
	<.0001	**0.0001**	**<.0001**	**<.0001**
UEM School	0.005	–0.004*	–0.119***	–0.053***
	0.1205	0.0585	<.0001	<.0001
Log(TNA)	0.007	0.000	0.090**	0.015
	0.4464	0.9367	0.0331	0.2443
$[\text{Log(TNA)}]^2$	–0.003***	0.000***	0.011**	–0.001
	0.0005	0.0076	0.0028	0.3576
Fund Age (log)	0.020***	0.000	–0.084***	0.013*
	0.0004	0.8702	<.0001	0.0559
Manager Tenure (log)	0.023***	0.005***	–0.025	–0.016**
	<.0001	<.0001	0.2252	0.0242
UIVY-plus School	–0.010*	0.003**	0.039*	0.007**
	0.0755	0.0353	0.0602	0.039
Intercept	0.537***	0.200***	4.241***	1.337***
	<.0001	<.0001	<.0001	<.0001
Year FE	Yes	Yes	Yes	Yes
Investment Style FE	Yes	Yes	Yes	Yes
Graduation Decade FE	Yes	Yes	Yes	Yes
Observations	11,052	11,048	3,941	2,437
R-squared	0.28	0.25	0.31	0.31

Table 9 – Graduate exposure to the EMH and portfolio characteristics
The table reports coefficient estimates and p-values of OLS regressions of the portfolio Active Share measure, Tracking Error, number of stocks, and market beta on an indicator variable for all managers who obtained their graduate degree from an efficient market school (GEM School), an indictor variable for all managers who obtained their graduate degree from an efficient market school three years before the school published its first efficient market article or later (G-Exposure to the EMH), an indicator variables for managers with an MBA degree, (log of) total net asset value, (log of) total net asset value squared, (log of) fund age, (log of) manager tenure, and an Ivy league indicator for managers who obtained their graduate degree from an Ivy league school (plus Caltech, University of Chicago, Duke, MIT, Stanford, and the Universities of Cambridge and Oxford). All models include year–, portfolio investment style–, and manager graduation decade–fixed effects. Standard errors in all models are adjusted for clustering at the year–level. (^) indicates all models estimated at annual frequency. (***), (**), and (*) indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

	Active Share	Tracking Error	Num. Stocks (log)^	Market Beta^
G-Exposure to the EMH	**–0.056*** **	**–0.002**	**0.105*** **	**0.046** **
	<.0001	**0.6222**	**0.0059**	**0.0197**
GEM School	–0.002	–0.004***	–0.020	–0.061***
	0.7876	0.0111	0.3577	0.0006
MBA Degree	–0.005	0.003	0.034	0.010
	0.672	0.1115	0.275	0.3483
Log(TNA)	0.039***	0.005*	0.032	–0.003
	0.0002	0.0643	0.4436	0.8536
$[\text{Log(TNA)}]^2$	–0.006***	–0.001***	0.017***	0.001
	<.0001	0.0005	0.0001	0.4439
Fund Age (log)	0.018***	0.000	–0.086***	0.015**
	<.0001	0.8107	<.0001	0.0104
Manager Tenure (log)	0.010***	0.004***	0.004	–0.016**
	0.0031	0.0021	0.7664	0.0445
GIVY-plus School	0.027***	0.002	–0.022	–0.027***
	<.0001	0.0957	0.2826	0.0015
Intercept	0.656***	0.104***	3.978***	0.935***
	<.0001	<.0001	<.0001	<.0001
Year FE	Yes	Yes	Yes	Yes
Investment Style FE	Yes	Yes	Yes	Yes
Graduation Decade FE	Yes	Yes	Yes	Yes
Observations	7,349	7,345	2,591	2,437
R-squared	0.30	0.26	0.39	0.31

Table 10 – Exposure to the EMH and fund performance, expenses, and flows
The table reports coefficient estimates and p-values of OLS regressions of fund annualized raw and benchmark-adjusted returns (net of expenses), expense ratio, and capital flows on an indicator variable for all managers who obtained a degree from an EM school, an indictor variable for all managers who obtained a degree from an efficient market school three years before the school published its first efficient market article or later (Exposure to the EMH), past net return (in the flow regression), (log of) total net asset value, (log of) total net asset value squared, (log of) fund age, (log of) manager tenure, and an indicator for managers with a graduate degree. All models include year- and manager graduation decade-fixed effects. Standard errors in all models are adjusted for clustering at the year–level. All models are estimated at annual frequency. (***), (**), and (*) indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

	Net Return	Benchmark-adjusted Net return	Expense Ratio^	Fund flows
Exposure to the EMH	**–0.001**	**0.001**	**–0.001*****	**0.051****
	0.8981	**0.851**	**0.0006**	**0.0167**
EM School	–0.003	–0.004	0.000*	–0.024
	0.5883	0.4899	0.0439	0.1737
Past Net Return				1.153***
				0.0037
Log(TNA)	0.004	0.004	–0.001**	–0.059**
	0.6519	0.561	0.0017	0.0119
$[Log(TNA)]^2$	0.000	0.000	0.000*	0.004**
	0.8835	0.9594	0.589	0.0387
Fund Age (log)	–0.009***	–0.010***	0.000	–0.087***
	0.0057	0.0007	0.5642	<.0001
Manager Tenure (log)	0.003	0.004	0.000*	0.007
	0.3695	0.147	0.0571	0.4525
Graduate Degree	–0.001	0.000	0.000	–0.009
	0.871	0.9032	0.992	0.6335
Intercept	0.096	0.092	0.013***	0.699***
	0.2969	0.3378	<.0001	0.0023
Observations	3,922	3,922	3,937	3,801
R-squared	0.52	0.53	0.19	0.16

Table 11 – Exposure to the EMH and fund flows: Interactions

The table reports coefficient estimates and p-values from OLS regressions of portfolio capital flows on an indicator variable for all managers who obtained a degree from an EM school, an indictor variable for all managers who obtained a degree from an efficient market school three years before the school published its first efficient market article or later (EMH Exposure), a fund/manager characteristic (CHAR), and an interaction term of the exposure variable with the characteristic. We consider three different characteristics: fund expense ratio; past fund net return; and an indicator variable for a fund from a family with at least five different funds. All models also include the fund and managerial controls from the last model of Table 9 and year-, portfolio investment style-, and manager graduation decade-fixed effects. Standard errors in all models are adjusted for clustering at the year–level. All models are estimated at annual frequency. (***), (**), and (*) indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

	CHAR [Expense Ratio]	CHAR [Past Return]	CHAR [Family]
EMH Exposure	0.216***	0.023	–0.004
	<.0001	0.4451	0.8565
EM School	–0.023	–0.023	–0.021
	0.2140	0.2143	0.1988
EMH Exposure*CHAR	**–16.200*** **	**0.105**	**0.144*** **
	<.0001	**0.3638**	**0.0045**
CHAR	1.844	1.141***	–0.021
	0.4461	0.0039	0.3630
Fund & Manager Controls	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Investment Style FE	Yes	Yes	Yes
Graduation Decade FE	Yes	Yes	Yes
Observations	3,792	3,801	3,801
R-squared	0.18	0.17	0.18

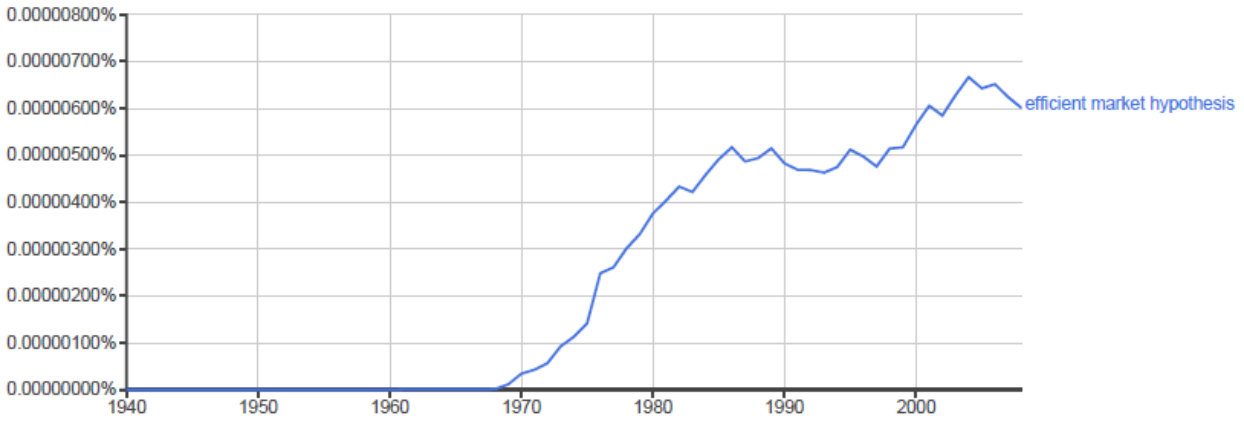

Figure 1. References to the expression "Efficient Market Hypothesis" over time
The figure presents the annual frequencies of the expression "efficient market hypothesis" found in sources printed between 1940 and 2008 based on Google Ngram Viewer (smoothing of 3).